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SEEDING SHORTLEAF PINE IN THE MISSOURI OZARKS

Shortleaf pine stands can be established in the Missouri Ozarks by sowing pine seed much as a farmer sows oats. By direct seeding, low-quality woodlands and abandoned old fields can be converted to pine to increase productivity. Seedbed preparation usually is needed to convert hardwood stands, but total cost is still only one-third to one-half that of planting nursery-grown seedlings.

Techniques have been developed that make direct seeding cheaper, faster, and easier than planting. It can be done over a longer period — from December 1 to April 15 — and improved bird, rodent, and insect repellents to protect the seed make direct seeding both reliable and practical. The techniques described here were developed by the Central States Forest Experiment Station in cooperation with the Clark National Forest and the Missouri Conservation Commission. The District Ranger's staff, Salem, Missouri, cooperated in most of the larger field trials.

SELECT SUITABLE SITES

Nearly all forested areas within natural range of shortleaf pine are suitable (fig. 1). In the Missouri Ozarks, avoid such sites as very steep, droughty slopes, gravelly stream bottoms, rocky glades, or other areas where the black oak site index is less than 45.

There is one more important limitation: livestock must be excluded from all seeded areas to prevent grazing and trampling of the seedlings. On open rangeland, pine reforestation by any method is risky.

FIGURE 1. — A well-stocked 4-year-old shortleaf pine stand established by broadcast seeding in the Missouri Ozarks.

KILL UNMERCHANTABLE HARDWOODS

Because of frequent summer droughts in Missouri, all available moisture must be reserved for the young trees, whether they are planted or seeded. To do this, all commercial products should be harvested and herbicides should be applied by approved methods to kill unwanted brush and hardwood trees before the pine seeds germinate in early April. The dead standing trees provide partial shade, helpful to pine seedlings during the first summer. Delaying hardwood control until the pine seedlings are established results in too few seedlings and poor growth for those that do survive (fig. 2). Besides, spraying foliage with herbicides durving the first summer after germination will kill or damage the succulent young pine seedlings.

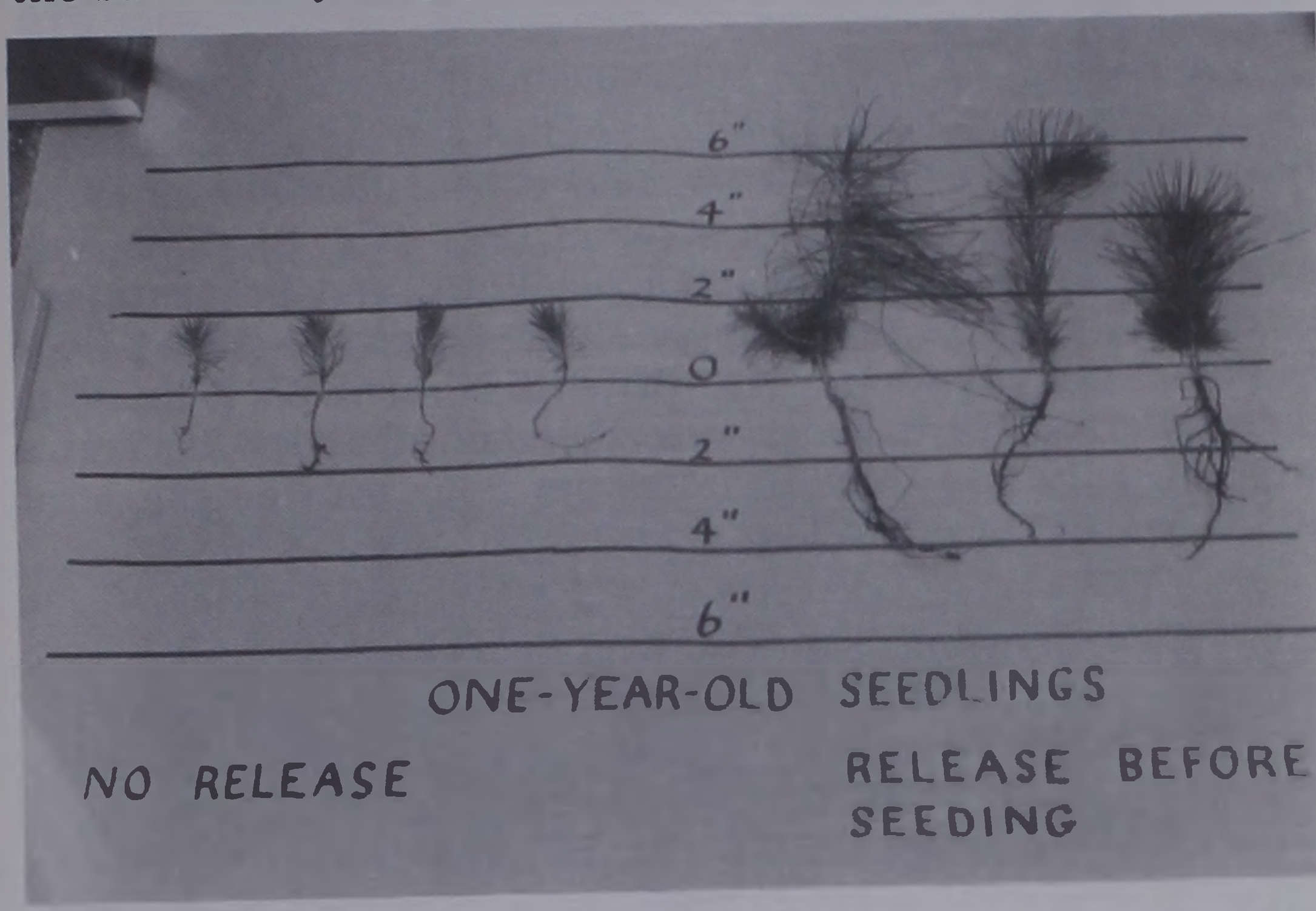

FIGURE 2. — Development of shortleaf pine seedlings after one growing season. Released seedlings are thrifty and vigorous while unreleased seedlings have many yellowish-brown needles.

The importance of early, complete, and continuing hardwood control on seeded areas in the Missouri Ozarks cannot be overemphasized. It is false economy to spend money for seed, repellent treatments, and seedbed preparation and then to lose most of the seedlings within 1 or 2 years by failing to release them.

PREPARE THE SEEDBED

Seedbed preparation seldom is needed in old fields because the native grasses and herbs do not form a heavy sod. Scattered trees and shrubs on old fields should be killed with herbicides.

In hardwood stands where the dead leaves form a continuous layer more than 1-inch deep, a suitable seedbed must be prepared. Heavy litter keeps the seed from reaching the soil where it can germinate and develop. If the litter is less than 1-inch thick or occupies less than 35 percent of an area, however, you can direct seed without special treatment.

A prescribed burn in late November or early December, after leaf fall, is an effective and cheap way to reduce a heavy leaf layer. The fire should consume only the loose, dead leaves, leaving a thin layer of duff (fig. 3). This duff reduces frost heaving of small seedlings, and prevents soil erosion. A hot fire that completely destroys the forest floor is unnecessary and is very difficult to control. A buildup index of from 25 to 40, a spread index of about 30, and a wind velocity less than 10 miles per hour provide the most suitable burning conditions.

Where burning is impractical, the seedbed can be prepared by machine or by hand. Disking or bulldozing the litter, followed immediately by broadcast seeding, is as successful as the use of fire (table 1), but costs much more — about $10.00 per acre. The only object in scarifying is to loosen the litter and mix it with the soil, so only trees interfering with tractor movement need to be pushed over. The seeds should be sown immediately because they sink easily into the loosened soil and litter, and as the litter settles the seeds are, in effect, planted.

Proper seedbed preparation can be the difference between success and failure in dry years. Because drought conditions cannot be predicted, preparing the seedbed where necessary is good insurance.

FIGURE 3. — A suitable seedbed can be made at least cost by a prescribed burn prior to seeding: Top — oak-hickory stand before it was burned in December; Bottom — same area after prescribed burn was completed. The heavy leaf layer has been consumed but a thin layer of organic matter still covers the soil.

TABLE 1. — Effect of seedbed treatment and date of sowing on success of direct seeding[1]

Year and month seeded	Seedbed treatment	Seedlings per acre: First year: Spring	Seedlings per acre: First year: Fall	Seedlings per acre: Second fall	Stocked milacres[2]: First year: Spring	Stocked milacres[2]: First year: Fall	Stocked milacres[2]: Second fall
		Number	Number	Number	Percent	Percent	Percent
January 1963	None	525	750	620	21	27	27
January 1963	Burned	1,450	1,625	1,525	43	49	40
January 1963	Disked	1,375	1,545	1,400	41	45	40
January 1964	None	1,215	1,320	--	39	35	--
January 1964	Burned	2,660	3,425	--	70	74	--
April 1964	Burned	1,715	2,375	--	55	67	--
January 1964	Bulldozed	3,125	3,800	--	72	75	--

1/ All plots seeded at the rate of 24,000 viable treated seeds per acre.

2/ Percent of milacres stocked with at least one seedling.

LOCAL SEED IS BEST

If possible, get seed from within 100 miles of the area to be seeded. If local seed is not available, seed from the same general latitude as the Missouri Ozarks may be used. Seed can be purchased from the State Forester or from reliable commercial tree-seed dealers.

Always buy the best available seed; poor-quality seed seldom is a bargain. Seed should meet certain standards of purity, soundness, viability, and moisture content. Lots should be 98-percent pure by weight and contain 10 percent or less empty seeds by number. Germination of at least 70 percent is preferred and the moisture content should not exceed 10 percent.

Stratification or repellent treatments greatly increase the original weight of the seed. So, if the dealer is going to treat the seed, it should be weighed before he treats it and purchased on a dry-weight basis with treatment costs priced separately.

TREAT SEED WITH REPELLENTS

Seed must be treated with repellents. A new liquid repellent that is easy to apply and virtually dust-free is recommended. This repellent is a blend of Arasan 42-S, a liquid suspension of thiram, and Endrin 50-W, a wettable powder. Thiram is a bird repellent and fungicide, and Endrin protects against insects and rodents. A latex sticker is added to bind repellents to the seed.

To prepare the repellent-sticker blend:

(1) Place 5 pounds of Stauffer's Endrin 50-W in a 5-gallon container, add 2½ gallons of Arasan 42-S, and stir with a paddle until the powder is wetted. *Caution: Endrin is highly toxic. Rubber gloves must be worn while treating seed and a respirator must be used when preparing the repellent blend.* After the treated, coated seed is dry it is nearly dust-free and is not dangerous to handle.

(2) Beat to a smooth, lump-free mixture with a paint mixer attached to an electric drill.

(3) Add 1½ pints of *undiluted* Dow Latex 512-R to another 2½ gallons of Arasan 42-S and stir briefly.

(4) Blend the two mixtures by pouring from one can to another several times.

This final mixture is a stable suspension and can be prepared several days in advance of seed treatment and stored in a glass container or in the original coated metal cans at above-freezing temperatures.

Care should be taken when storing the sticker and repellents. The latex sticker is a suspension and should not be stored in uncoated metal containers or at temperatures below 32 degrees F. or above 110 degrees F. These temperature extremes cause the suspension to be broken and all adhesive properties to be lost. Arasan 42-S and Endrin 50-W should be stored at temperatures above 32 degrees F. Any unused mixture of the chemicals and sticker should be discarded each year.

After the liquid repellent-sticker blend has been prepared, it can be most easily applied to large quantities of seed by using a 3¼-cubic-foot concrete mixer. Put 50 pounds of seed (dry weight) in the mixer and add 1.2 gallons of liquid repellent while the mixer is turning. After 2 minutes of tumbling, add 8 tablespoons of aluminum powder and mix for another minute. The aluminum powder lubricates the seed so it flows freely through the seeders. Dry the treated seed for 3 or 4 hours by spreading it 3 to 4 inches deep on paper or canvas and stirring occasionally.

Small seed lots of 2 to 5 pounds can be treated in a large can or bucket by adding 3 fluid ounces of liquid repellent per pound of seed and stirring with a paddle.

To check the durability of the seed coating, place several hundred seeds in a small wire basket and wash under a cold-water faucet for 2 minutes. If more than two-thirds of each seed surface remains coated, the seed is suitable for field use.

Stratification is necessary to insure prompt germination of spring-sown seed. To stratify seed, soak it in water for 24 hours at room temperature, drain it, place it in a polyethylene plastic bag that is tied shut. Then refrigerate at 38 degrees F. for 30 to 45 days. A regular home refrigerator can be used. Water should be added occasionally to rewet seeds if they dry out. Do not put more than 25 pounds of seed in each bag and turn the bags weekly.

After the seeds have been stratified, air-dry them to remove surface moisture and apply the liquid repellent-sticker blend. Treated stratified seed may be stored in a refrigerator at 38 degrees for a month if weather conditions prevent immediate sowing. Do not attempt to stratify seed that has first been repellent treated.

BROADCAST THE RIGHT AMOUNT OF SEED

Seed can be successfully sown at any time from December 1 to April 15. In general, the best results have been obtained by sowing in December, January, or February using unstratified repellent-treated seed. After March 1 stratified seed must be used.

If you do not know the germination percentage and number of seeds per pound, you can broadcast seed ¾ pound per acre (dry weight). It is much better, however, to make a germination test. If you have high-quality seed you may be able to sow less than ¾ pound per acre and save money. On the other hand, if your seed is poorer than average, a larger amount per acre will be needed to obtain an adequately stocked stand.

The amount of seed actually needed per acre can be determined as follows: First, determine the number of seeds per pound and the percent that will germinate. Assume tests show your seed lot contains 44,000 seeds per pound and 55 percent will germinate. Next, find the number of viable seeds per pound: 44,000 x 0.55 = 24,200. About 24,000 viable seeds per acre are needed to establish a satisfactory stand, so you should then determine the weight of seed you must sow to get this number of viable seeds — in this case, 24,000/24,200 = 0.99 pounds of untreated seed per acre.

Stratification and repellent treatments greatly increase seed weight by about 25 percent and 20 percent, respectively. The actual percent of weight increase for a given seed lot can be found by weighing the seed before treatment and again just before it is sown. Assuming that the percent weight increase in the previous example is 45, the weight of treated seed to sow per acre is 0.99 x 1.45 = 1.44 pounds per acre.

DISTRIBUTE SEED EVENLY

Seed may be broadcast sown with hand-operated cyclone seeders, or by airplanes and helicopters. Cyclone seeders are well suited for sowing small or irregular-shaped areas (fig. 4). From 10 to 20 acres per man-day can be covered in this way. As many as six men with seeders can be used in a crew, with the men walking about 25 feet apart in an echelon line. Seeding strips can easily be marked with a string payed out from a cone carried on a workers back. Workers should wear gloves and tight-fitting clothing, but a respirator is not necessary when using liquid-repellent-coated seed.

FIGURE 4. — Hand-operated "cyclone" seeders distribute seed quickly and accurately.

Good seed distribution is as important as seeding rate, so the cyclone seeders must be calibrated. To check initial hopper-gate settings (about 1/8 inch), sow a known quantity of seed on an area of known size. A 1/2-acre calibration area is adequate. Correct the hopper-gate opening if necessary to get uniform distribution of seed over the area.

Aerial seeding may be cheaper on large tracts. Up to 1,500 acres per day can be sown with a fixed-wing airplane and about 2,500 acres with a helicopter.[1]

SPOT SEED UNPREPARED SITES

Where you are unable to prescribe burn or disk to prepare a seedbed, you can spot seed to get a pine stand. Spot seeding requires less seed per acre, but is much slower. It is useful where the tracts to be seeded are small or where the seed supply is limited. It is also useful for increasing the number of seedlings in poorly stocked stands. To spot seed, scrape the litter from 18-inch-square spots and lightly press 10 to 15 seeds per spot into the soil.

Special spot-seeding tools are available that combine a rake with a device for dropping a certain number of seeds in each spot. Such tools are convenient but not necessary. A fire rake can be used for litter removal, and seed can be carried in a bucket, or in the pocket of an apron or coat. Again, only treated seed should be sown. About 2 to 4 acres per man-day can be seeded where seed spots are spaced 6 to 8 feet apart.

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1 *For a detailed discussion of aerial seeding and calibration techniques see "Guides for direct-seeding slash pine" by Mann, W. F. and Derr, H. J. U. S. Forest Serv. Res. Paper SO-12, 27 pp., illus. Southern Forest Experiment Station, New Orleans, La.*

EXAMINE SEEDED AREAS AFTER ONE GROWING SEASON

Survival on seeded areas should be checked at the end of the first growing season. A successful seeding should result in at least 1,000 well-distributed seedlings per acre. If seedlings are more or less uniformly spaced from 6 to 10 feet apart, the area is adequately stocked.

In most cases, this kind of success can be depended upon if four rules are followed: (1) Kill brush and hardwood trees with herbicide prior to seed germination. (2) Where litter is over 1-inch thick, burn or scarify to prepare the seedbed. (3) Use repellent-treated seed. (4) Distribute 24,000 viable seeds per acre evenly over the area.